



Original Article

Comparison of surgical efficacy in total en-bloc Holmium laser enucleation of the prostate: Self-learning vs. mentor-guided training

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Abstract

Objective: To compare the efficacy of prostate enucleation using Holmium laser (HoLEP) with total en bloc technique between urologists learning HoLEP independently versus those receiving mentorship. The aim of this study is to provide valuable insights for the optimization of surgical education.

Materials and Methods: A retrospective study was conducted at Thammasat University Hospital, Thailand, comparing the outcomes of surgery carried out by two urologists performing their first 30 HoLEP cases. One of the surgeons learned independently through online surgical videos, while the other received direct mentorship from an experienced HoLEP surgeon. The primary outcome was enucleation efficiency (EE), measured as weight of prostate tissue removed (grams) per minute of enucleation time. Secondary outcomes included perioperative complications, blood loss, catheterization time, length of hospital stay, and functional outcomes such as changes in International Prostate Symptom Score (IPSS), Qmax, and post-void residual urine (PVR).

Results: Sixty patients underwent HoLEP between 2019 and 2025, with 30 patients operated on by each surgeon. The analysis of enucleation efficiency (EE) between the two surgeons reveals notable differences in surgical performance. Across the 30 cases, a consistently higher EE value was recorded in the cases operated on by the mentor-guided surgeon suggesting a more efficient enucleation process. The analysis revealed that the mean EE in the mentor-guided surgeon group was 1.15 ± 0.44 g/minute, whereas in the patients operated on by the self-learning surgeon it was 0.71 ± 0.20 g/minute. This difference was found to be statistically significant ($p < 0.001$). Additionally, a higher improved Qmax of 9.2 ± 4.6 ml/sec was shown in the mentor-guided surgeon group in comparison to the cohort operated on in the self-learning group which was 12.9 ± 8.8 ($p < 0.05$). There was also a decrease in some of 30 day post-op complications specifically hematuria 13 (43.3%) vs 1 (3.3%) ($p < 0.05$), capsular perforation 2 (6.7%) vs 0 (0.0%) ($p < 0.05$) and urinary retention 12 (40.0%) vs 0 (0.0%) ($p < 0.05$) in the mentor guided patients.

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Conclusion: In this study it was found that mentor-guide training in HoLEP significantly enhances enucleation efficiency in comparison to self-learning. These findings highlight the importance of structured training in improving surgical proficiency and patient outcomes in HoLEP surgery.

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Introduction

Benign prostatic hyperplasia (BPH) is a prevalent condition in urological practice and a major cause of lower urinary tract symptoms (LUTS)¹⁻³, significantly affecting the quality of life of affected individuals. Treatment options range from medical therapy to surgical intervention when indicated.

Holmium laser enucleation of the prostate (HoLEP) is a well-established, minimally invasive surgical technique for BPH treatment. In this procedure greater efficacy has been demonstrated in comparison to open prostatectomy also offering other advantages including reduced bleeding, shorter catheterization duration, and reduced hospital stay.⁴⁻⁶ HoLEP is particularly beneficial in the treatment of large prostates (> 80 g) and is now considered a standard surgical option regardless of prostate size.⁷⁻¹³

Among various HoLEP techniques, the total en-bloc HoLEP technique has been proposed to improve surgical precision and efficiency.¹⁴ However, this technique is challenging and requires significant surgical experience. Literature suggests there is a steep learning curve, with a wide range of estimates from 20 to 500 cases being offered for surgeons to achieve proficiency. The difficulty of mastering this procedure independently may lead to higher complication rates and increased surgical failure.¹⁵⁻¹⁷

In many training centers, urologists begin learning HoLEP independently, often relying on online resources such as surgical videos. However, it remains unclear whether self-learning is as effective as mentor-guided training in developing proficiency.¹⁸⁻²⁰ The aim of this study is to compare the surgical efficiency of urologists learning HoLEP independently versus those receiving mentorship, providing valuable insights for the optimization of surgical education.

Materials and Methods

Patient selection

This study was conducted at Thammasat University Hospital, Thailand, in 2023. Ethical

approval was given by the Thammasat University Ethics Committee in Human Research (protocol number MTU-EC-SU-0-261/67, approve March 15, 2025). Data was collected by the investigators. No external funding was received for this study.

Inclusion criteria were male patients diagnosed with BPH who underwent total en-bloc HoLEP technique between 2019 and 2025. The selection criteria were: refractory acute urinary retention, recurrent gross hematuria, recurrent urinary tract infection, bladder diverticulum or calculi due to BPH, bilateral hydronephrosis with renal function impairment, symptomatic BPH requiring surgical intervention, and prostate volume > 30 ml.

Exclusion Criteria were patients who declined HoLEP, patients with incomplete medical records, patients who had contraindications for prostate surgery, for example multiple system atrophy (MSA) or severe pre-existing urinary incontinence.²¹

In the mentored group, a mentor was present in the operative field throughout the surgical procedure to supervise the operating surgeon. The surgeon was able to ask question, seek guidance, or request demonstration of specific steps as needed. In contrast, the self-learning group performed the operation in accordance with standard surgical protocols, without a mentor present.

Outcomes

The primary outcome was enucleation efficiency (EE), defined as the amount of prostate gland removed in grams divided by the enucleation time.

Secondary outcomes were changes in hematocrit, changes in International Prostate Symptom Score (IPSS), and Qmax improvement.

The following postoperative metrics were also recorded: postoperative post-void residual (PVR) urine volume, catheterization time, length of hospital stay, hematuria, bladder perforation, dysuria, urinary tract infections (UTIs), stress and urge urinary incontinence, urinary retention, and hospital readmission rates.

Statistical analysis

A pilot study was conducted in patients who underwent total en-bloc HoLEP technique at Thammasat University Hospital between January 1, 2022, and December 31, 2023. Each study group consisted of 10 patients. The EE in the self-learning group was calculated to be 0.78 g/minute, while in the mentor-guided group, it was 1.05 g/minute.

Sample size estimation was performed using STATA version 15.1, with a type I error (p-value) of 0.05 and a power of 80%. The standard deviation (SD) for EE in both groups was 0.35 g/min. Based on these values, the required sample size was determined to be 30 patients per group, resulting in a total of 60 patients for the study.

For statistical analysis, continuous data was analyzed using a Student's T-test. Categorical data was assessed using the Chi-square test. To further analyze the primary outcome, multivariate regression analysis was conducted to adjust for potential confounders, ensuring a more accurate assessment of the relationship between surgical training methods and enucleation efficiency.

Results

Participants

Sixty patients were included in the study, with 30 patients being operated on by each surgeon. Demographic and baseline characteristics are summarized in Table 1.

Outcomes

Primary outcome: enucleation efficiency

The analysis of EE between the two surgeons reveals notable differences in surgical performance. Across the 30 cases, in the mentor-guided surgeon group consistently higher EE values were demonstrated suggesting a more efficient enucleation process (Fig. 1). The analysis indicated that the mean EE in the mentor-guided surgeon group was 1.15 ± 0.44 g/minute (Fig. 2), whereas in the self-learning surgeon group, it was 0.71 ± 0.20 g/minute. This difference was found to be statistically significant ($p < 0.001$) (Fig. 3). Data pertinent to other outcomes is reported in Table 2

Additionally, during the study, it was observed that prostate volume may have an impact on EE. Larger prostate glands tended to be associated with higher EE values, suggesting a potential correlation between prostate size and surgical efficiency. This trend is illustrated in the table below. Any complications at 30-days post-operative are reported in Table 3.

Discussion

This study provides insights into the role of mentorship in the process of learning to carry out HoLEP. Prior research suggests that HoLEP offers superior outcomes compared to TURP and open prostatectomy in terms of Qmax, PVR, complication rates, and recurrence rates.⁶⁻¹³ Total en bloc HoLEP has been proposed as a more precise

Table 1. Preoperative demographic data

Demographic data	Self-learning	Mentor-guided	P-value
Age, years, mean (SD)	71.2 (6.6)	69.4 (7.5)	0.327
BMI, kg/m ² (SD)	25.0 (5.0)	24.4 (3.2)	0.573
Alpha blocker n (%)	30 (100.0)	30 (100.0)	1.000
5-ARIs n (%)	30 (100.0)	30 (100.0)	1.000
IPSS, mean (SD)	25.4 (4.0)	24.2 (2.5)	0.111
Prostate volume, g, median (IQR)	72.9 (28-145)	83.4 (40-140)	0.151
Antiplatelet/anticoagulant, n (%)	6 (20.0)	5 (17.0)	0.123
Hematocrit, %, mean (SD)	40 (4.4)	37.4 (3.1)	0.010
Serum PSA, ng/ml, median (IQR)	7.9 (2-39)	7.8 (1-20)	0.925
Catheter dependent n (%)	17 (57.0)	22 (73.0)	1.000
Qmax, ml/sec, median (IQR)	9.9 (1-23)	5.3 (1-10)	< 0.001
PVR, ml, median (IQR)	129.3 (0-480)	365.3 (112-800)	< 0.001

BMI = body mass index, BPH = benign prostatic hyperplasia, IQR = interquartile range, IPSS = International Prostate Symptom Score, Qmax = maximum urine flow rate

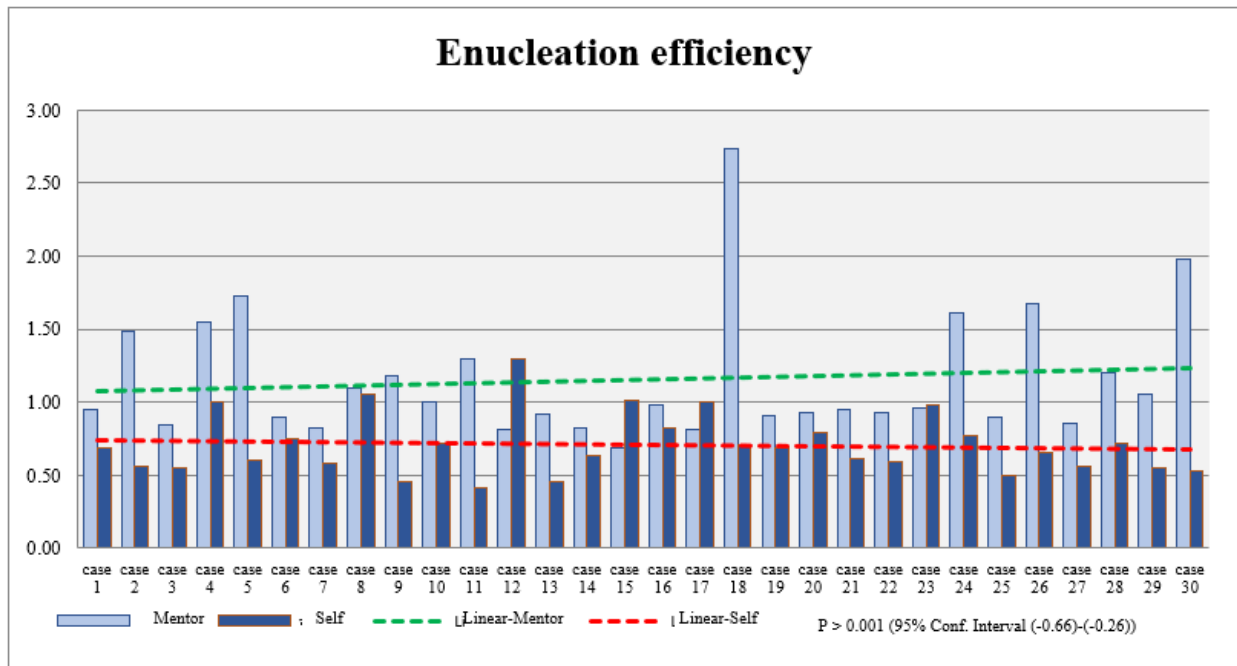


Figure 1. Enucleation efficiency.

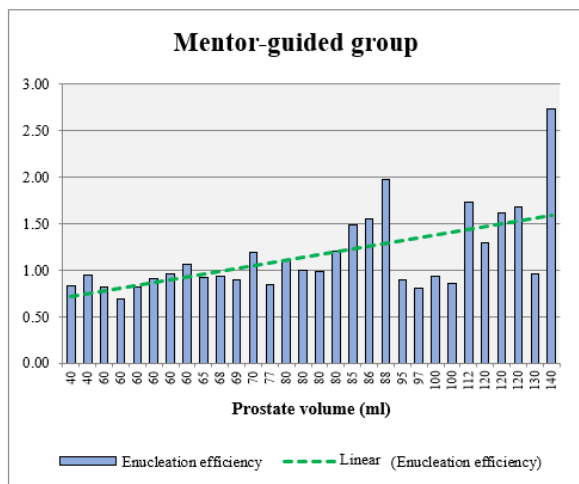


Figure 2. Mentor-guided group.

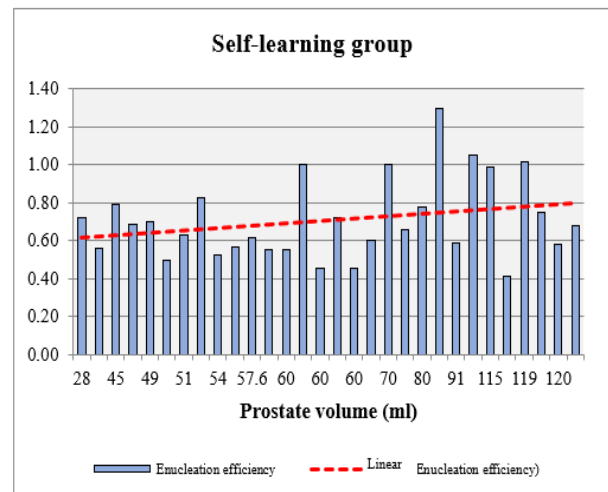


Figure 3. Self-learning group.

technique but is technically demanding. Learning curve data suggest that expertise requires 20-50 cases, but some studies report the need for up to 500 cases for full proficiency.¹⁷ In addition, conversion to TURP was found to be common in 8 of the studies reviewed. The conversion rates were 30.0% in the first 30 operations. This number was decreased to 16.0% in the subsequent 30 cases²², this highlights that the procedure is challenging to perform successfully.

The trend of EE over sequential cases in this study suggests a potential learning curve effect, particularly in the case of the mentor-guided group, whose EE values demonstrate a more

noticeable upward trend. A previous study has shown that when expert surgeons perform various reconstructive surgeries, participants valued the quality and the educational benefit with regard to the improvement of knowledge and surgical technique and also a decrease in the occurrence of complications.²³ This may imply that the mentor-guided approach facilitates a more rapid acquisition of surgical proficiency in comparison to self-directed learning. In contrast, self-learning surgeon EE values remain within a narrower range, potentially reflecting a more gradual adaptation to the carrying out of the HoLEP technique.

**Table 2.** Operative outcome data

Outcome	Self-learning	Mentor-guided	P-value
Operative time, minutes, median (IQR)	152.1 (67-405)	146.2 (100-315)	0.669
Enucleation time, minutes, median (IQR)	69.0 (38-140)	56.3 (34-110)	0.020
Time to stop bleeding, minutes, median (IQR)	13.0 (5-40)	17.1 (9-33)	0.022
Morcellation time, minutes, median (IQR)	23.6 (3-140)	25.2 (9-69)	0.790
Enucleation efficiency, g/minutes, mean (SD)	0.7 (0.2)	1.2 (0.4)	< 0.010
Morcellation efficiency, g/minutes, mean (SD)	2.08 (0.9)	2.48 (1.05)	< 0.010
IPSS reduction, mean (SD)	20.0 (4.8)	17.7 (2.7)	0.023
Improved Qmax, ml/sec, mean (SD)	9.2 (4.6)	12.9 (8.8)	0.212
Post-op PVR, ml, median (IQR)	20.3 (0-94)	26.1 (0-60)	0.285
Hct change, %, mean (IQR)	1.6 (-3-6)	0.1 (-4.6-3.3)	0.005
Enucleation tissue, g, median (IQR)	49.3 (21-138)	62.7 (33-142)	0.039
Length of hospital stay (day), mean (SD)	4.2 (2.4)	4.0 (1.2)	0.685
Catheter time (day), mean (SD)	3.7 (3.0)	3.8 (1.3)	0.827
Discharge without catheter, n (%)	28 (93.3)	29 (96.7)	0.562
Conversion rate to TURP, n (%)	2 (8.0)	0 (0.0)	0.012

BMI = body mass index, BPH = benign prostatic hyperplasia, IQR = interquartile range, IPSS = International Prostate Symptom Score, Qmax = maximum urine flow rate

Table 3. Post-operative 30 days operation.

30-day complications	Self-learning	Mentor-guided	P-value
Hematuria, n (%)	13 (43.3)	1 (3.3)	> 0.001
Capsular perforation, n (%)	2 (6.7)	0 (0.0)	> 0.001
Urinary retention, n (%)	12 (40.0)	0 (0.0)	> 0.001
Stress urinary incontinence, n (%)	5 (16.7)	5 (16.7)	1.000
Urge urinary incontinence, n (%)	3 (10.0)	3 (10.0)	1.000
Urinary tract infection, n (%)	5 (16.7)	1 (3.3)	0.080
Readmission rate, n (%)	0 (0.0)	0 (0.0)	1.000

The study also found that the mentor-guided group was able to further improve certain surgical outcomes, such as an increased improved Qmax after surgery, when compared to the self-directed learning group. The mentor-guided group showed a statistically significant reduction in 30-day post-surgical complications, including hematuria, urinary tract infection, capsular perforation and urinary retention, in comparison to the self-directed learning group. This demonstrates significant benefits for patients undergoing HoLEP surgery. Additionally, it was found that surgeons in the mentor-guided group did not convert from HoLEP to TURP at any time, whereas two cases of conversion were observed in the self-taught group.

These findings suggest that mentorship plays a crucial role in enhancing enucleation efficiency, potentially allowing surgeons to achieve higher procedural proficiency in a shorter learning period.

Overall, the preliminary data suggest that mentorship may accelerate the learning process, leading to improved enucleation efficiency. However, further validation with a larger sample size and prospective rather than retrospective studies is warranted to establish definitive conclusions regarding the impact of training methodology on surgical performance in HoLEP procedures.

This study has several limitations. First, the retrospective nature of the design inherently limits the ability to establish causal inferences

between the surgical training method and enucleation efficiency. The reliance on medical records may introduce potential bias, including selection bias and variability in documentation quality. Second, the sample size was relatively small, with only 30 cases per surgeon, which may affect the generalizability of the results. A larger cohort would be necessary to confirm the observed trends and further validate the impact of mentorship on surgical efficiency. Lastly, the findings of this study are specific to the total en-bloc HoLEP technique and may not be directly applicable to other variations of the HoLEP procedure.

Despite these limitations the findings of this study highlight the importance of structured mentorship in improving surgical efficiency in HoLEP. Moving forward, the development of standardized mentorship-based training programs should be prioritized to enhance the learning experience for urologists. These programs could incorporate supervised hands-on training, stepwise skill progression, and competency-based assessments to ensure that surgeons achieve proficiency in a safe and efficient manner.

Additionally, further prospective studies are needed to validate the long-term impact of mentorship on surgical outcomes. Such studies should focus on the evaluation of not only EE but also patient-centered outcomes, including postoperative recovery, complication rates, and overall quality of life. A long-term follow-up of mentored and self-taught surgeons could provide valuable insights into the sustainability of their acquired skills and the potential reduction in procedural complications over time. By establishing evidence-based training guidelines, the adoption of HoLEP could be expanded, ultimately improving patient care and surgical success rates.

Conclusion

Mentorship in HoLEP significantly enhances the efficacy of enucleation in comparison to self-learning. These findings highlight the importance of structured mentored training in improving surgical proficiency and patient outcomes. The findings of this study are beneficial for future urologists who wish to begin performing this procedure, as they will receive support from appropriate professionals within an established support system. This will ensure that future HoLEP surgical procedures are more efficient

and directly beneficial to the healthcare system of Thailand. Further studies are warranted to refine HoLEP training models.

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Conflicts of Interest

The authors declare no conflict of interest.

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